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Injection Moulding Simulation and Experimental Validation of Hearing Aid Shells

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This paper presents the validation results of the Moldex3D simulations and experiments carried on a complex 3D part, it critically analyzes the capability of Moldex3D and provides the guideline for more accurate simulation with the commercial software. Moldex3D with Boundary Layer Meshing (BLM) mode was adopted in this work to simulate the injection molding process of a hearing aid shell made of Polybutylene Terephthalate (PBT) filled with 30% glass fiber. The typical hearing aid shells are complex thin-walled structures made by injection molding. Highly sophisticated molds and lots of process optimizations by trial and errors are needed to make successful shells for hearing aids. In this context, a dedicated simulation tool can be very useful to reduce the time and cost for developing the new hearing aids. In this work, the injection molding experimental validation of the Moldex3D simulation was conducted for the upper shell of a hearing aid. With the pressure sensors integrated in the molding tool, real cavity pressure data was collected and the real filling time was estimated to replicate the processing conditions in the simulation. Injection time, injection pressure; pressure loss and warpage were taken as the main comparison criteria. Different parameter settings in Moldex3D were investigated to find their influence on the accuracy of the simulation. Results showed that the injection molding process prediction from the simulation was relatively precise when the nozzle geometry, the pressure effect on the viscosity and the determination of a proper heat transfer coefficient (HTC), etc. were considered. The agreement observed between the warpage of the experimental molded parts and simulated parts was not good. Warpage were dominated by the fiber orientation which was extremely dependent on the filling HTC and the RPR (Retarding Principal Rate Model) used in Moldex3D for the fiber orientation model.